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INVESTIGATION OF QUESTION OF FLANGES FOR LIGHT CAST IRON PIPE[1]

By John Knickerbacker

The question of flanges for light cast iron pipe has come up for discussion at different times, but up to now no final action has been taken. The American Society of Mechanical Engineers at its meeting on December 3 to 6, 1918, received a report from its committee on light flanges, in which report a "proposed low-pressure standard for end flanges, bolting and body thicknesses—50 pounds working pressure" is given.

The flanges proposed for 50 pounds working pressure by the American Society of Mechanical Engineers are of the same thicknesses and diameters and have the same diameters of bolt circles and the same number of bolts as the American Standard Flanges for 125 pounds steam working pressure; but the bolts are of smaller diameters than the sizes used in the American Standard Flanges for 125 pounds steam working pressure. The American Standard Flanges for 125 pounds working pressure became effective January 1, 1914, through the recommendation of the American Society of Mechanical Engineers.

It is surely desirable to arrive at some standard or standards as soon as possible for light flanges, provided the standard or standards would meet with the approval of the engineers, the users, and the manufacturers of cast iron pipe, valves, and fittings. To bring this to the attention of this Association and those interested in this question, figures 1 to 12 show in full size the thicknesses of pipe and thicknesses of flanges for American Water Works Association classes A, B and C pipe, the flanges for these pipes being calculated by the formula, thickness of flange equals one and one-half times thickness of pipe, plus one-eighth of an inch; the thicknesses of pipe of the American Gas Institute, and the thicknesses of flanges and bolt circles adopted by it; the American Society of

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[1] Read at the Buffalo Convention June 10, 1919.

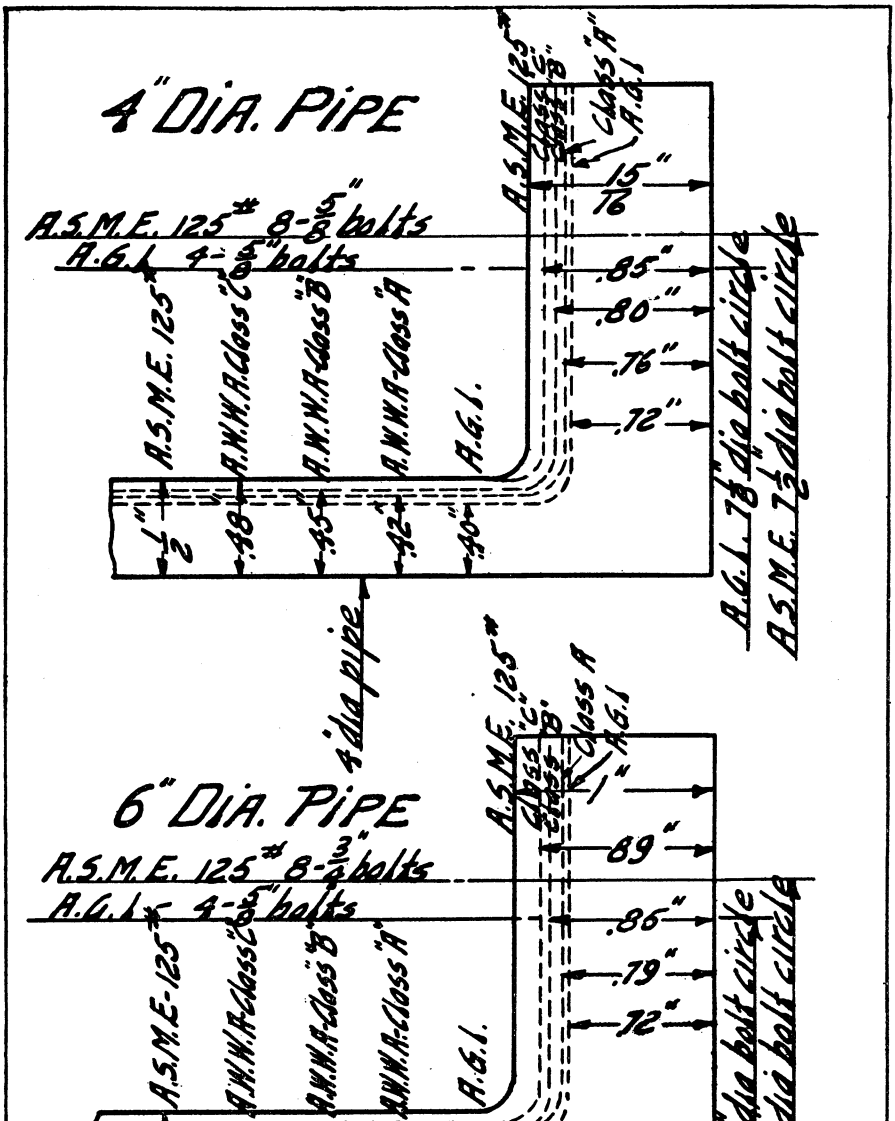

FIG. 1. FLANGES FOR 4-INCH AND 6-INCH PIPE

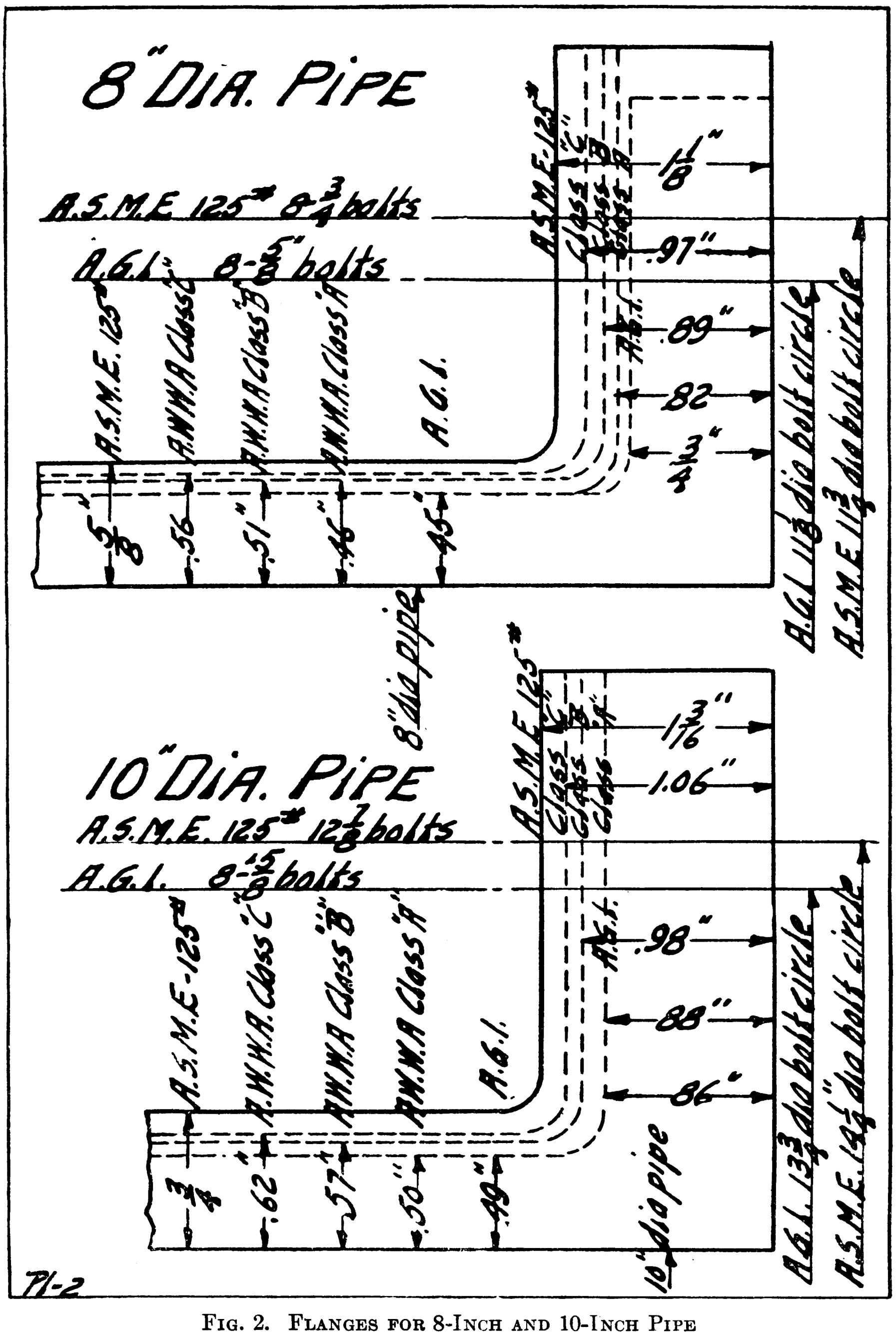

FIG. 2. FLANGES FOR 8-INCH AND 10-INCH PIPE

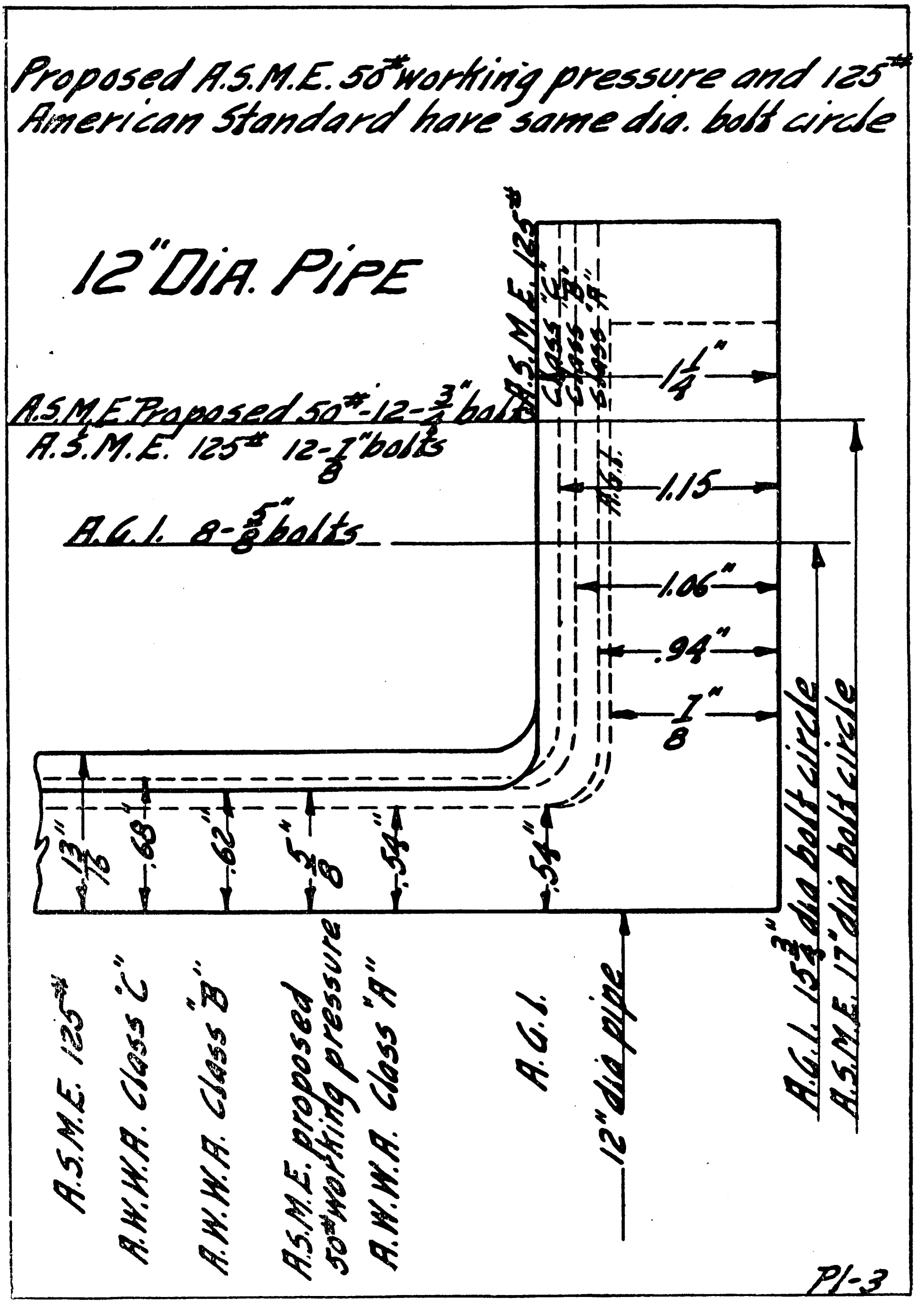
Proposed A.S.M.E. 50# working pressure and 125# American Standard have same dia. bolt circle
12" DIA. PIPE
A.S.M.E. Proposed 50#-12-3/4" bolts
A.S.M.E. 125# 12-7/8" bolts
A.G.I. 8-5/8" bolts
A.S.M.E. 125#
Class "C"
Class "B"
Class "A"
A.G.I.
1 1/4"
1.15
1.06"
.94"
7/8"
13/16"
.68"
.62"
5/8"
.54"
.54"
A.S.M.E. 125#
A.W.W.A. Class "C"
A.W.W.A. Class "B"
A.S.M.E. proposed 50# working pressure
A.W.W.A. Class "A"
A.G.I.
12" dia pipe
A.G.I. 15 3/4" dia bolt circle
A.S.M.E. 17" dia bolt circle
Pl-3

FIG. 3. FLANGE FOR 12-INCH PIPE

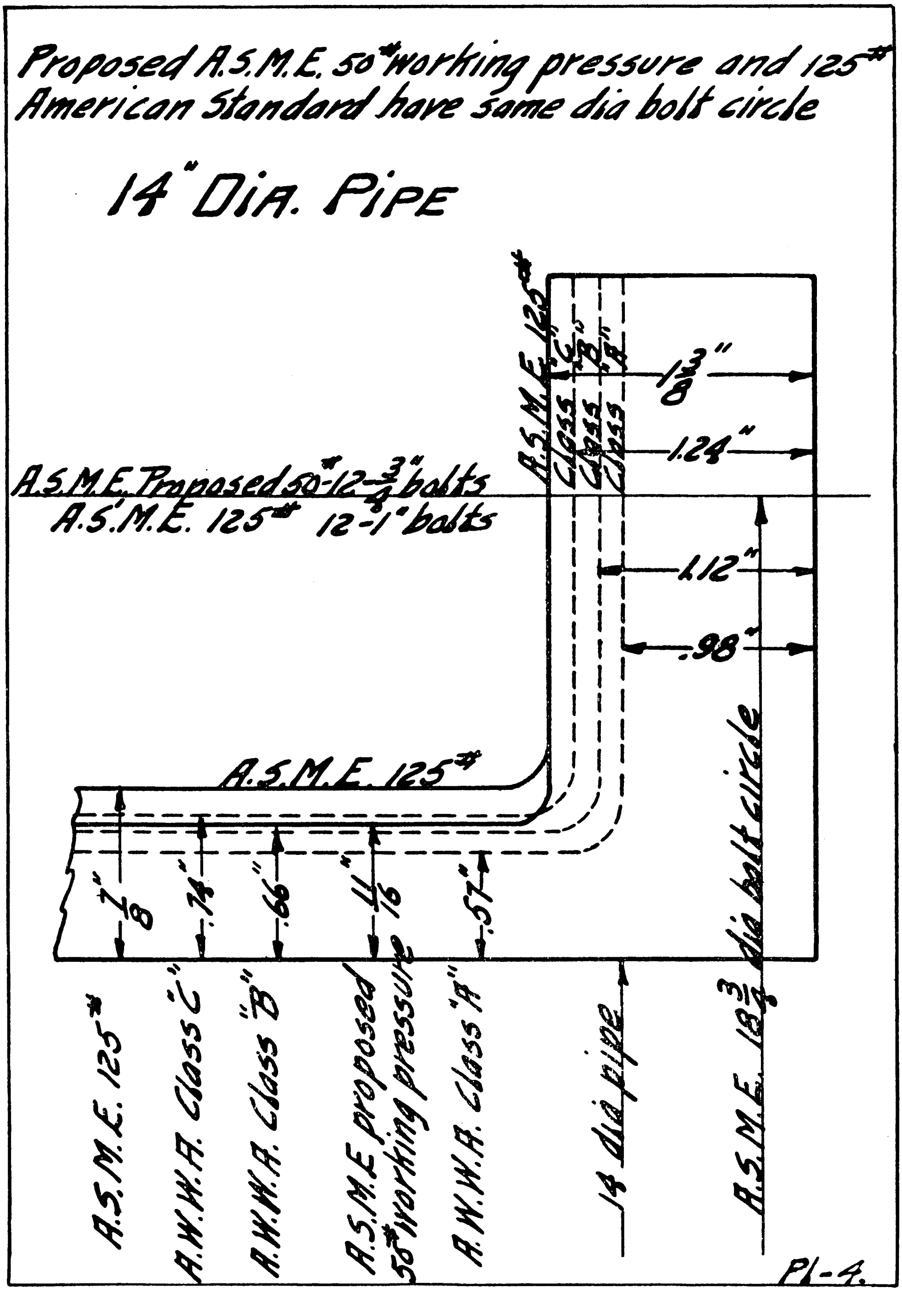

FIG. 4. FLANGE FOR 14-INCH PIPE

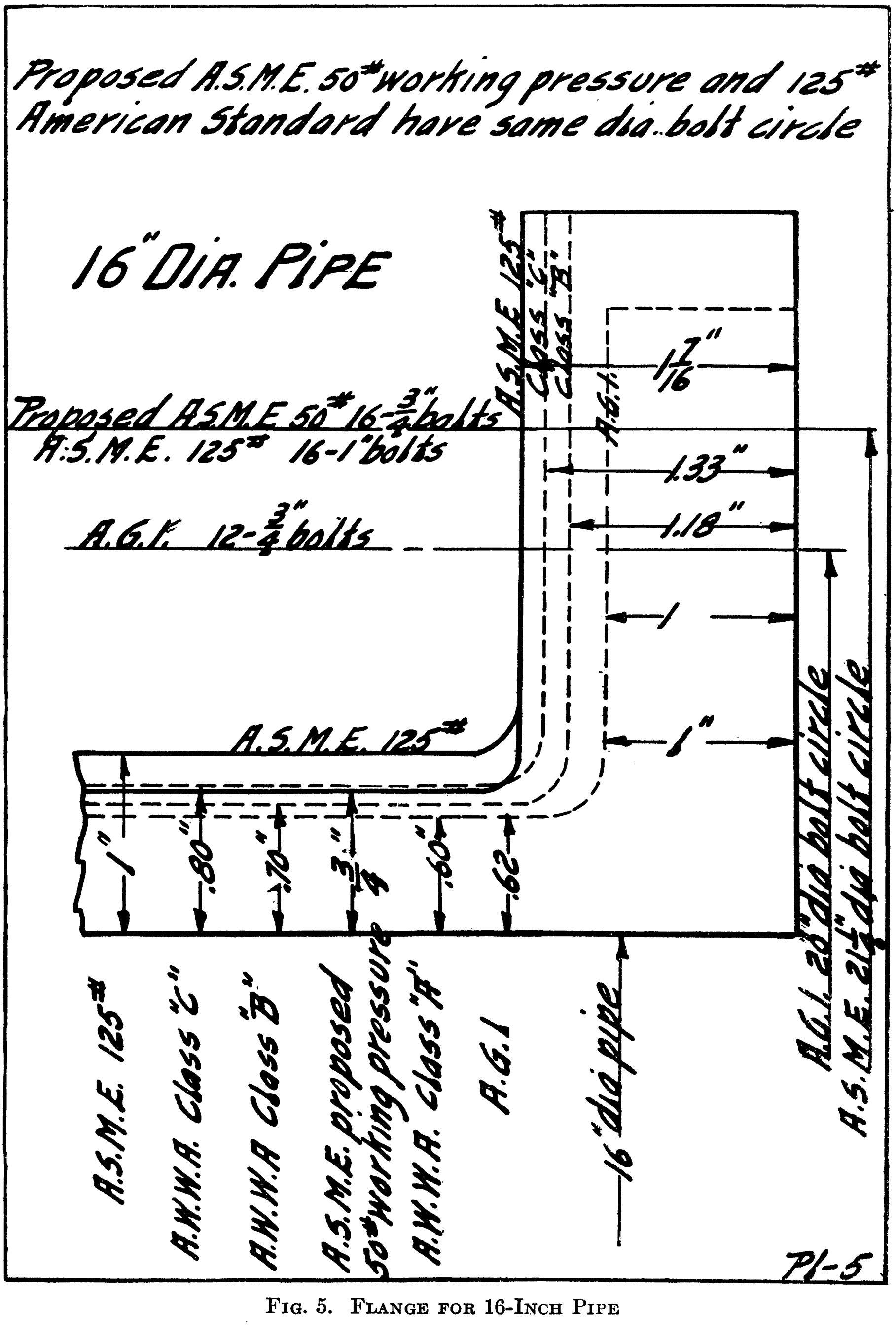
Proposed A.S.M.E. 50# working pressure and 125# American Standard have same dia. bolt circle
16" DIA. PIPE
A.S.M.E. 125#
Class "C"
Class "B"
A.G.I.
1 7/16"
Proposed A.S.M.E. 50# 16-3/4" bolts
A.S.M.E. 125# 16-1" bolts
A.G.I. 12-3/4" bolts
1.33"
1.18"
1
1"
A.S.M.E. 125#
1"
.80"
.70"
3/4"
.60"
.62
A.S.M.E. 125#
A.W.W.A. Class "C"
A.W.W.A. Class "B"
A.S.M.E. proposed 50# working piping pressure
A.W.W.A. Class "A"
A.G.I
16" dia pipe
A.G.I. 20" dia bolt circle
A.S.M.E. 21 1/4" dia bolt circle
Pl-5

FIG. 5. FLANGE FOR 16-INCH PIPE

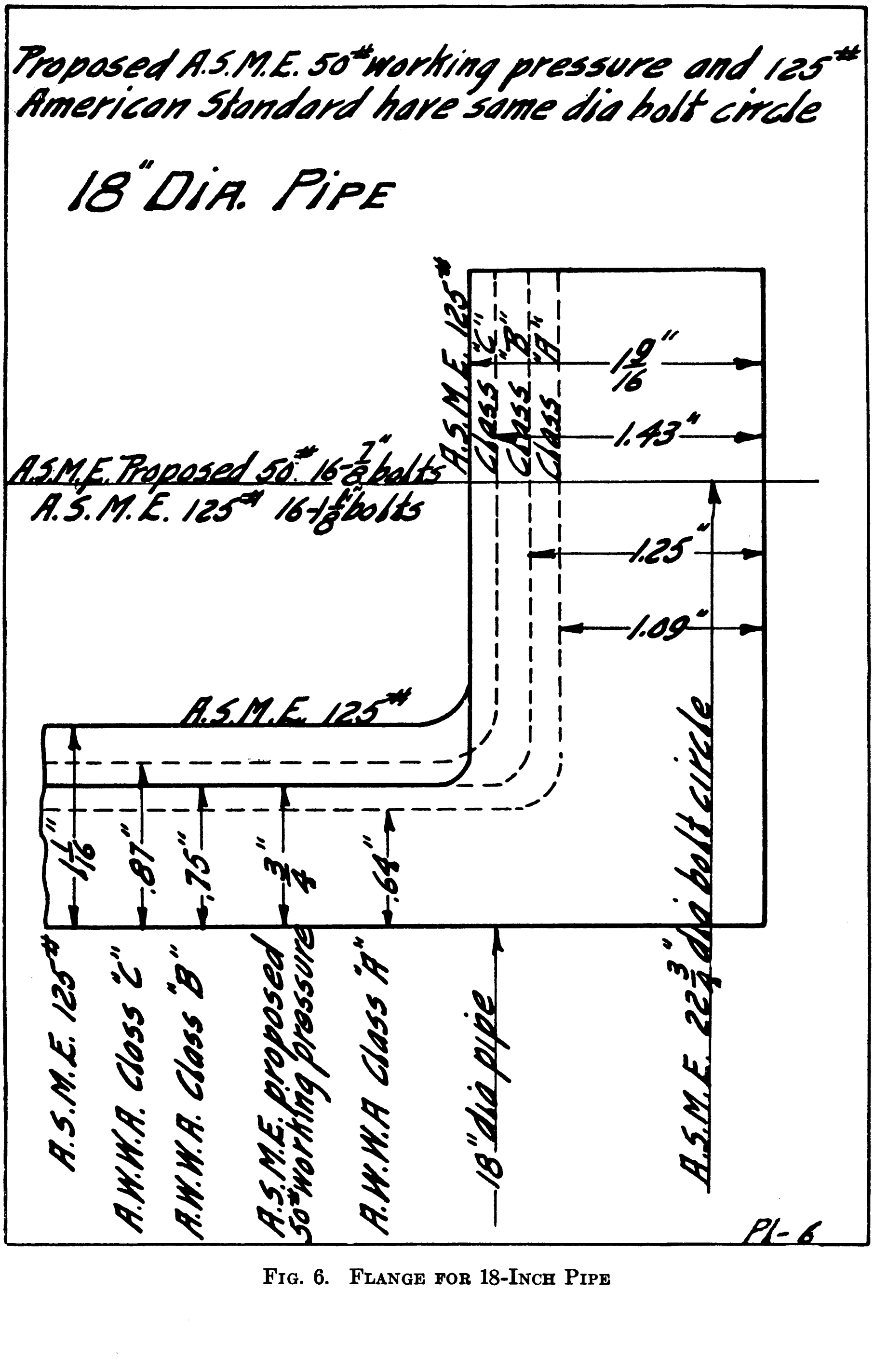
Proposed A.S.M.E. 50# working pressure and 125#
American Standard have same dia bolt circle
18" Dia. Pipe
A.S.M.E. 125#
Class "C"
Class "B"
Class "A"
1 9/16"
1.43"
A.S.M.E. Proposed 50# 16-7/8" bolts
A.S.M.E. 125# 16-1 1/8 bolts
1.25"
1.09"
A.S.M.E. 125#
1 1/16"
.87"
.75"
3/4"
.64"
A.S.M.E. 125#
A.W.W.A. Class "C"
A.W.W.A. Class "B"
A.S.M.E. proposed 50# working pressure
A.W.W.A. Class "A"
18" dia pipe
A.S.M.E. 22 3/4" dia bolt circle
Pl-6

FIG. 6. FLANGE FOR 18-INCH PIPE

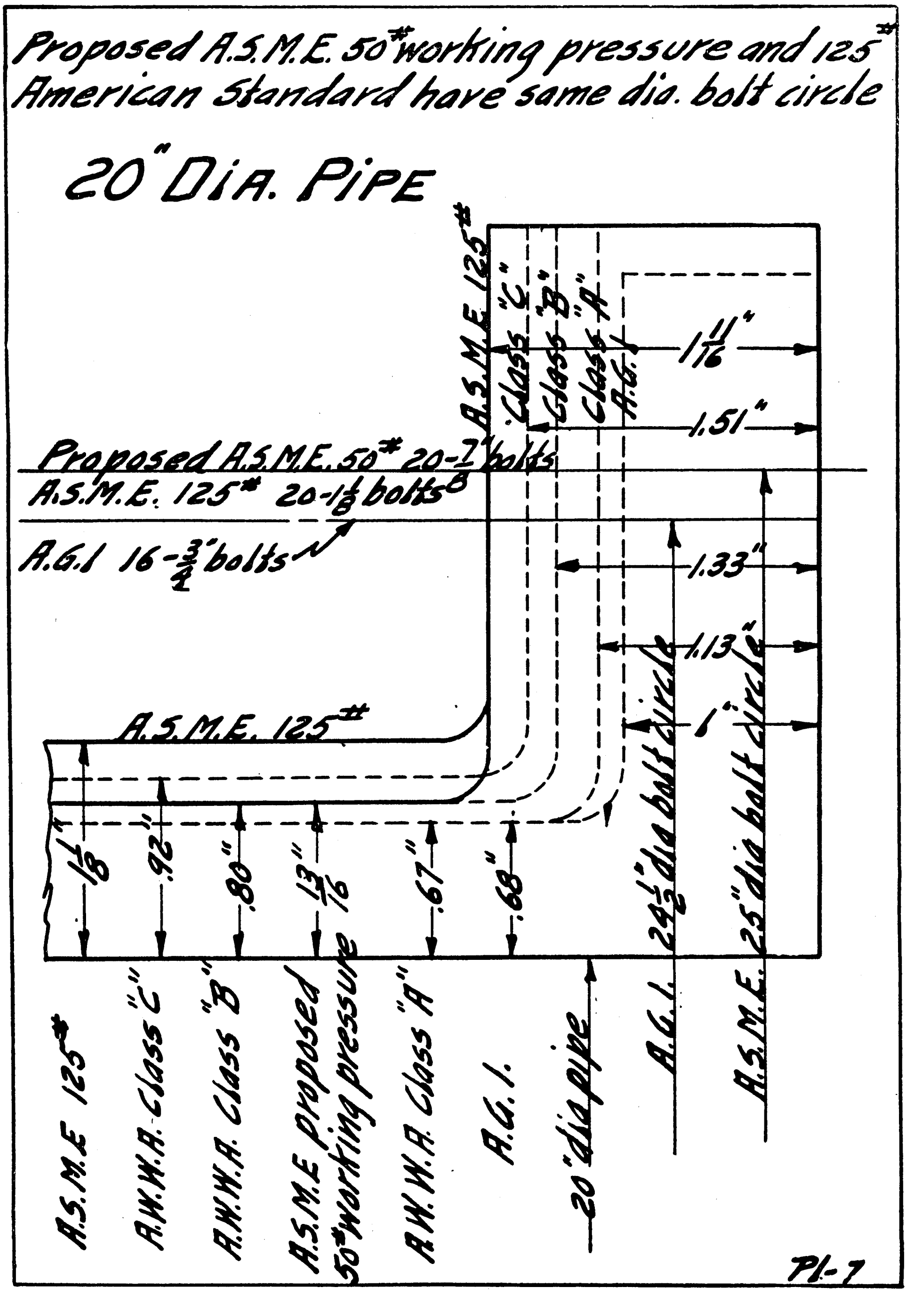
Proposed A.S.M.E. 50# working pressure and 125# American Standard have same dia. bolt circle
20" Dia. Pipe
A.S.M.E. 125#
Class "C"
Class "B"
Class "A"
A.G.I.
1 11/16"
1.51"
Proposed A.S.M.E. 50# 20-7/8" bolts
A.S.M.E. 125# 20-1 1/8 bolts
A.G.I 16-3/4" bolts
1.33"
1.13"
1"
A.S.M.E. 125#
1 1/8"
.92"
.80"
13/16"
.67"
.68"
A.G.I. 24 1/2" dia bolt circle
A.S.M.E. 25" dia bolt circle
A.S.M.E 125#
A.W.W.A. Class "C"
A.W.W.A. Class "B"
A.S.M.E proposed 50# working pressure
A.W.W.A. Class "A"
A.G.I.
20" dia pipe
Pl-7

FIG. 7. FLANGE FOR 20-INCH PIPE

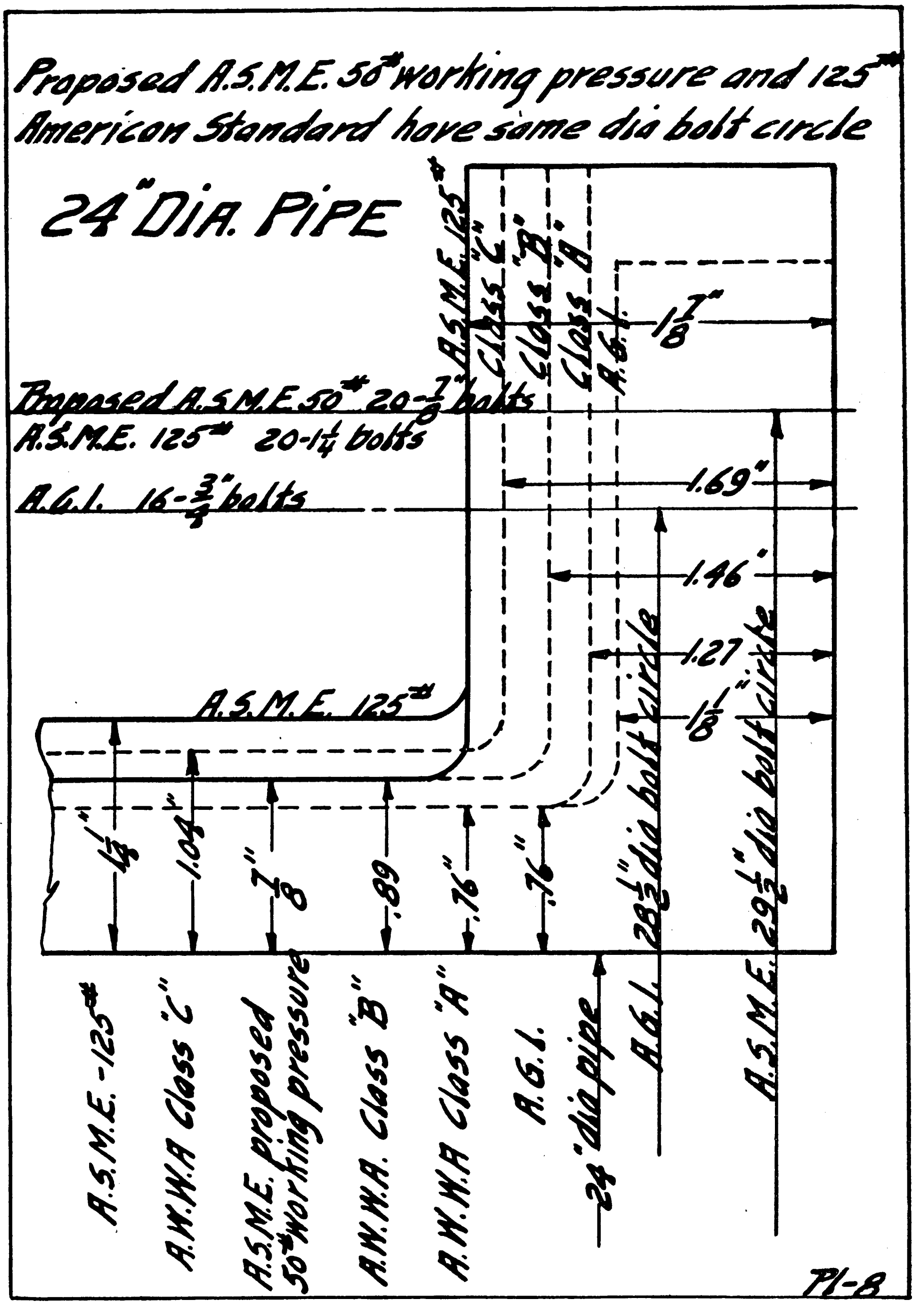

FIG. 8. FLANGE FOR 24-INCH PIPE

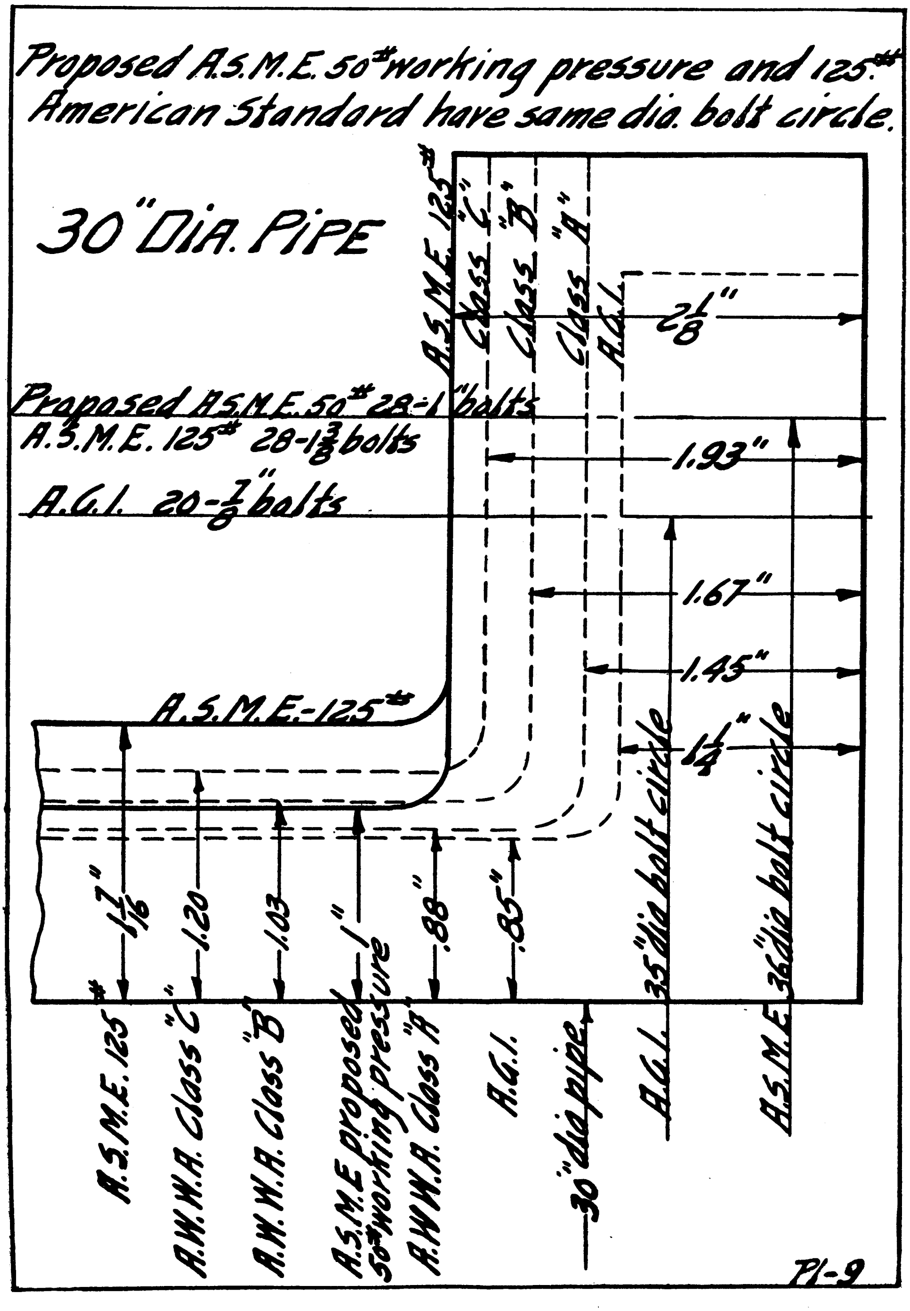

Fig. 9. Flange for 30-Inch Pipe

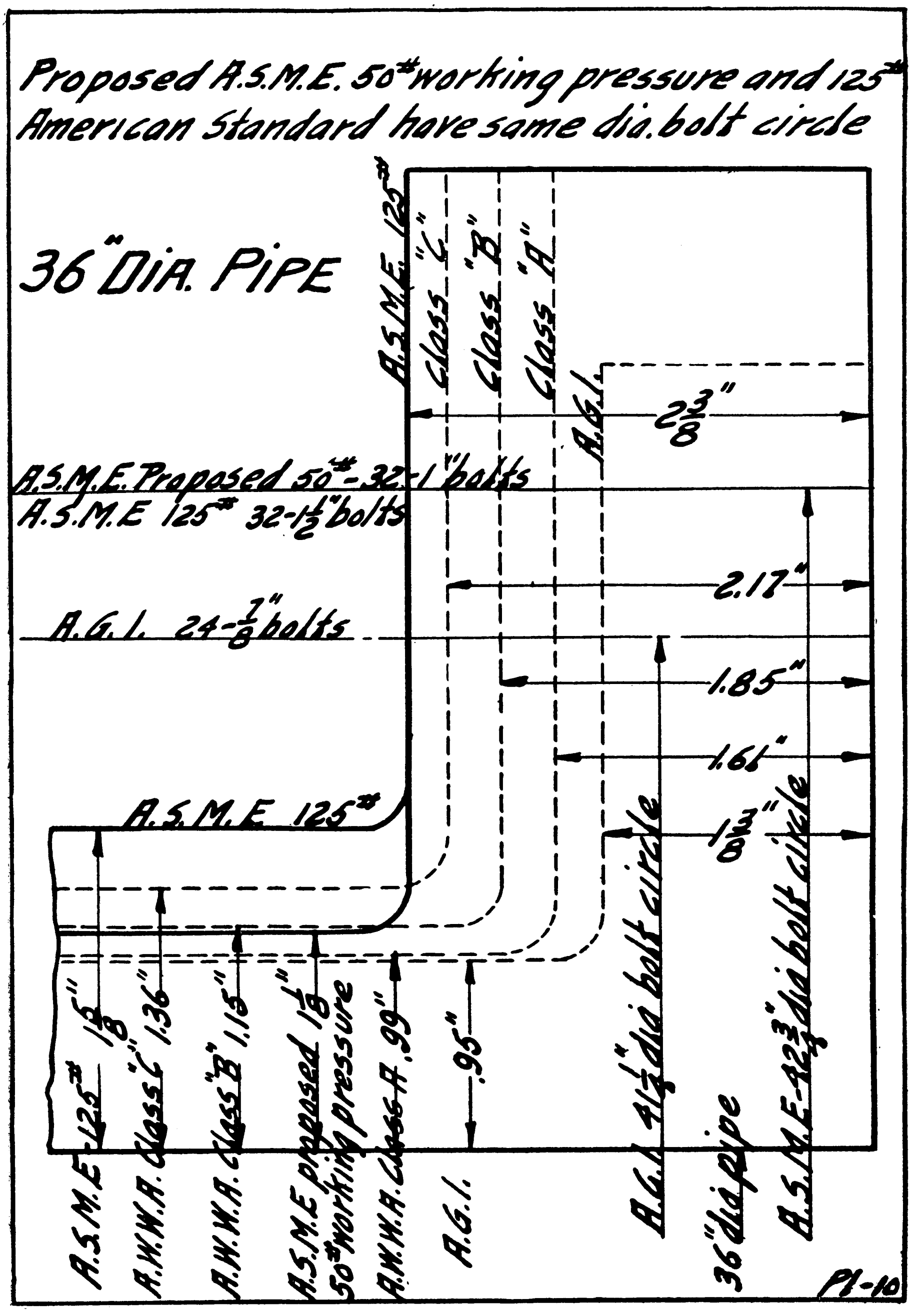
Proposed A.S.M.E. 50# working pressure and 125# American Standard have same dia. bolt circle
36" DIA. PIPE
A.S.M.E. 125#
Class "C"
Class "B"
Class "A"
A.G.I.
2 3/8"
A.S.M.E. Proposed 50#-32-1" bolts
A.S.M.E 125# 32-1 1/2" bolts
A.G.I. 24-7/8" bolts
2.17"
1.85"
1.61"
1 3/8"
A.S.M.E 125#
A.S.M.E 125# 1 5/8"
A.W.W.A. Class "C" 1.36"
A.W.W.A. Class "B" 1.15"
A.S.M.E proposed 1 1/8" 50# working pressure
A.W.W.A. Class A .99"
A.G.I. .95"
A.G.I. 41 1/4" dia bolt circle
36" dia pipe
A.S.M.E. 42 3/4" dia bolt circle
Pl-10

Fig. 10. Flange for 36-Inch Pipe

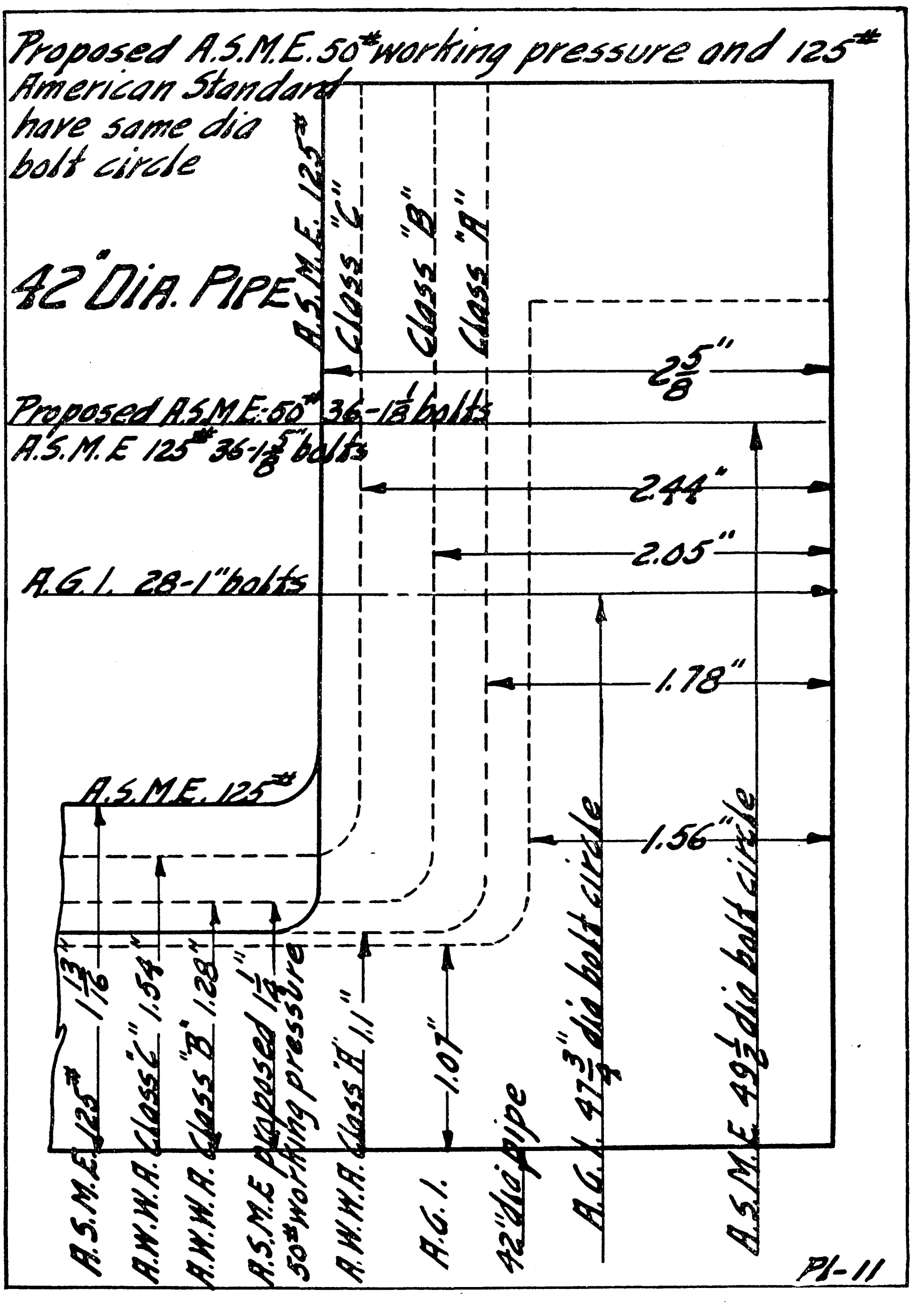
Proposed A.S.M.E. 50# working pressure and 125# American Standard have same dia bolt circle
A.S.M.E. 125#
Class "C"
Class "B"
Class "A"
42" DIA. PIPE
2 5/8"
Proposed A.S.M.E. 50# 36-1 1/8 bolts
A.S.M.E 125# 36-1 5/8" bolts
2.44"
2.05"
A.G.I. 28-1" bolts
1.78"
A.S.M.E. 125#
1.56"
A.G.I. 47 3/4" dia bolt circle
A.S.M.E. 49 1/2 dia bolt circle
A.S.M.E. 125# 1 3/16"
A.W.W.A. Class "C" 1.54"
A.W.W.A. Class "B" 1.28"
A.S.M.E proposed 1 1/4" 50# working pressure
A.W.W.A. Class "A" 1.1"
A.G.I. 1.07"
42" dia pipe
Pl-11

FIG. 11. FLANGE FOR 42-INCH PIPE

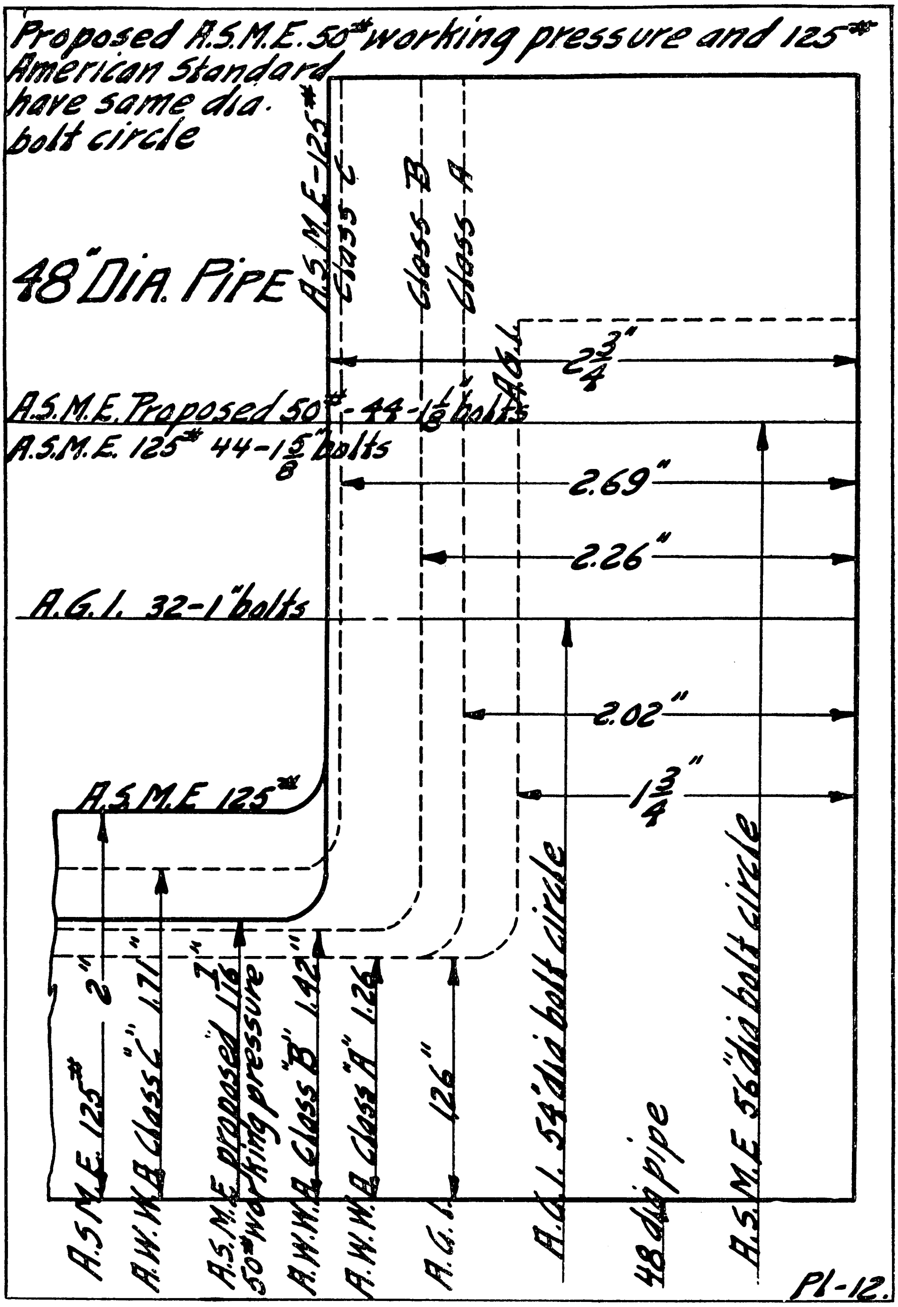
Proposed A.S.M.E. 50# working pressure and 125# American Standard have same dia. bolt circle
48" DIA. PIPE
A.S.M.E.-125#
Class C
Class B
Class A
A.G.I.
2 3/4"
A.S.M.E. Proposed 50# - 44-1 1/8" bolts
A.S.M.E. 125# 44-1 5/8" bolts
2.69"
2.26"
A.G.I. 32-1" bolts
2.02"
1 3/4"
A.S.M.E 125#
A.S.M.E. 125# 2"
A.W.W.A. Class "C" 1.71"
A.S.M.E. proposed 1 1/16" 50# working pressure
A.W.W.A. Class "B" 1.42"
A.W.W.A. Class "A" 1.26"
A.G.I. 126"
A.G.I. 54" dia bolt circle
48 dia pipe
A.S.M.E 56" dia bolt circle
Pl-12.

Fig. 12. Flange for 48-Inch Pipe

Mechanical Engineers proposed standard for 50 pounds working pressure, and the American Standard for 125 pounds steam working pressure.

These layouts visualize comparatively the different standards for each size shown and serve to bring to the attention of the person studying them the comparative proportions of the flanges and pipe thicknesses of the sizes largely used.

There is a serious question if the standard flange suggested by the American Society of Mechanical Engineers for pipe for 50 pounds working pressure is not too heavy and will not cause casting strains and shrinkage where the flange meets the pipe. Take, for example the 30-inch pipe. The class A, American Water Works Association pipe measures 0.88 inch thick. Would it be good foundry practice to cast a flange measuring $2\frac{1}{8}$ inches thick to this thin pipe, and if the pipe were increased in thickness about $\frac{1}{8}$ inch to 1 inch thick, the thickness proposed by the American Society of Mechanical Engineers for 50 pounds working pressure, would not the flanges $2\frac{1}{8}$ inches thick be too heavy for the pipe?

The American Gas Institute pipe thickness for 30-inch pipe is 0.85 inch. Taking the inside diameter of the flange at 31.7 inches on this 30-inch pipe, as 31.7 inches is the outside diameter of the pipe, the weight of the American Gas Institute flange is 102.4 pounds and the flange proposed by the American Society of Mechanical Engineers for light pipe is 215.5 pounds which is over twice as much as the American Gas Institute 30-inch flange. If the American Gas Institute flange is heavy enough for class A pipe, then for each flange 113.1 pounds would be wasted if the American standard flange were used; besides the poor casting that might result from casting such a heavy flange on a light pipe.

If a flange 1.67 inches thick were used on a 30-inch class B pipe, taking the outside diameter of the pipe as the inside diameter of the flange, it would weigh 169.38 pounds. The American Standard flange on this pipe would weigh 215.5 pounds, showing a saving of 46.12 pounds per flange.

If it were possible to use the American Gas Institute flange for the class A pipe, and a flange of the diameter of the American Standard, but between the thickness shown for the flanges for class A and class B pipe as calculated by the formula previously given, it might be a good solution of the question.

Would it not be a good idea for the Committee of this Association which has this matter in charge, to endeavor to take it up with like committees from the New England Water Works Association, the American Society of Mechanical Engineers, the American Gas Institute, the Cast Iron Pipe Manufacturers, the Committee of Manufacturers on Standardization of Fittings and Valves, and such other organizations as might wish to be represented? Is not this a question that should be settled as soon as possible by the representatives of all the parties concerned?

It is hoped that the line cuts which form part of this paper will prove of interest.

DISCUSSION

D. W. French: It is to be assumed that this question of flanges for light cast iron pipe has reference to water pipe to be laid in the ground. The speaker is in doubt about the advantage of flanged cast iron pipe for such purposes. Flanged pipe not only costs more than bell and spigot pipe but its use involves a special hazard where the main is under a pressure of 50 pounds or more. Many of us have had experiences with the settling of cast iron mains, which tends to cause leaking joints. If light cast iron flanged pipe settled the distortion might easily increase materially the 50 pounds working pressure to which parts of the metal would be subject, and hence there is a question as to the wisdom of using it.

W. H. Randall: The author recommends that this Association take up with other organizations this subject of standardization of cast iron flange pipe, which is a wise thing to do. It is absolutely necessary at times to use flange pipe, and a standardized pipe of this type will be helpful in obtaining prompt deliveries of a reliable product.

John Knickerbacker: The paper does not refer exclusively to flanges for pipe laid in the ground but covers all cases of flanged pipe. There is a manufacturers' committee on specifications for valves and fittings which has gone into this matter very carefully. The committee includes representatives of about forty makers of pipe and fittings, and it seems appropriate that it should be consulted in reference to this subject. The purpose in presenting the paper was to give the members definite information on the present status of the subject, so that any action taken might be based on a knowledge of what had been accomplished toward standardization to date.

President Henderson: The Association now has a committee on the revision of standard specifications for cast iron pipe and specials, which is working in coöperation with a similar committee of the New England Water Works Association and with manufacturers of pipe. The subject is one which falls within the scope of the work of that committee, and the paper is therefore referred to that committee for its consideration.